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"iRun!" An Evaluation of the Addition of Nutrition Education and a Fitness Log to an Existing After-School Fitness Program

Julia Holmes Bell
University of Tennessee, Knoxville, jbell48@vols.utk.edu

To the Graduate Council:

I am submitting herewith a thesis written by Julia Holmes Bell entitled ""iRun!" An Evaluation of the Addition of Nutrition Education and a Fitness Log to an Existing After-School Fitness Program." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Marsha L. Spence, Major Professor

We have read this thesis and recommend its acceptance:

Sarah E. Colby, Katie Kavanagh

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

“iRun!” An Evaluation of the Addition of Nutrition Education and a Fitness Log to an Existing After-School Fitness Program

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Abstract

Objective: The primary objective of this project was to evaluate if there were significant differences between pre- and post-outcomes for physical fitness levels, nutrition knowledge and preference, physical activity self-efficacy among conventional and experimental intervention groups.
Methods: This study was a convenience sample, pre-and post-test, quasi-experimental design with between-subject factors of nutrition education and a fitness log (receive education plus fitness log and did not receive education plus fitness log). Physical fitness was measured using the PACER fitness test; nutrition knowledge and preference and physical activity self-efficacy were assessed using The Catch nutrition knowledge and preference and physical activity self-efficacy survey.
Results: Nutrition knowledge and preference, physical fitness, and physical activity self-efficacy increased significantly in the experimental group ($p<.01$). Physical fitness significantly increased in the control group ($p<.01$).The experimental group's nutrition knowledge and preference significantly increased compared to the control from pre- to post-intervention ($p<.01$).
Conclusion: The iRun program showed that combining physical activity, nutrition education, and a fuel and fitness log may increase nutrition knowledge and preference, physical fitness, and physical activity self-efficacy. While the iRun program conventionally implemented without nutrition education increased fitness levels, the addition of nutrition education and fuel and fitness logs, increased the experimental groups' nutrition knowledge and preference and self-efficacy for physical activity in addition to increased fitness levels, all of which are important outcomes for childhood obesity prevention programs.

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Chapter 1

Literature Review

Prevalence and Risks of Childhood Obesity in the United States

The prevalence of childhood obesity in the United States has tripled over the previous 25 years, leading to an epidemic that must be addressed (Skelton, Cook, Auinger, Klein, & Barlow, 2009). Childhood obesity increases the risk of adult-onset metabolic syndrome, type two diabetes, and cardiovascular disease (Daniels et al., 2005). Not only are there increased risk for medical co-morbidities, but there are increased risks for social and emotional effects, such as lower self-esteem, depression, and behavior and learning problems (Daniels et al., 2005). Childhood and adolescence are crucial times for brain growth and learning experiences that do not need to be deterred by any of these medical, social, or emotional effects that obesity may cause. Furthermore, research has shown overweight and obese children are more likely to be overweight or obese in adulthood, leading to morbidity and increased healthcare costs (Freedman et al., 2005).

Classification of Overweight and Obesity for Children

Overweight and obesity are measured by calculating body mass index (BMI), but the American Academy of Pediatrics (AAP) suggests to use BMI childhood growth charts for classifying weight status in children (Barlow & Dietz, 1998). BMI is determined by an age- and sex-specific formula and the child’s height and weight, developed by the Centers for Disease Control and Prevention (CDC). Children and adolescents are considered overweight if age- and sex-specific BMI is equal to or greater than the 85^{th} percentile, but less than the 95^{th} percentile; they are considered obese if age- and sex-specific BMI is equal to or greater than the 95^{th} percentile (Skelton et al., 2009). BMI is an inexpensive and simple method for determining weight status in children and adolescents. There has been some criticism of using BMI, especially prior to adolescence. During this time, growth is not always proportional throughout the body and BMI may not be as accurate as other measures of adiposity. However, when BMI for age was compared to weight for height and Rohrer Index for age, the results showed BMI for age was the best measure for classifying children as overweight or obese (Mei et al., 2002).

Causes of Childhood Obesity

The proposed causes for the high obesity prevalence are excessive energy intake, less physical activity, and the physical and social environments (Varela-Moreiras, 2006). Excessive energy intake may be attributed to more calories being consumed, such as fast food and soft drinks, which are high in calories with little to no nutrient benefits. The increased consumption and portion sizes of fast food in conjunction with a rise in the consumption of soft drinks by children may dramatically increase their total caloric intake (St-Onge, Keller, & Heymsfield, 2003). One study showed that adolescents tended to overestimate portion sizes and had an absence of knowledge concerning certain food groups. The adolescents from the same study also lacked understanding of the connection between dietary behaviors and health-related diseases (Murimi, 2008). Another study showed that there was greater improvement in dietary habits when nutrition education was provided to children (Powers, Struempler, Guarino, & Parmer, 2005). The lack of nutritional knowledge with these lifestyle behaviors may contribute to the increased risk for child overweight and obesity. Further, most children do not meet the dietary recommendation for eating fruit and vegetables or whole grains (Centers for Disease Control and Prevention, 2014). Children also ingest up to 40% of their daily calories from added sugars and solid fat, and drinking more soft drinks than milk (Centers for Disease Control and Prevention, 2013).

Not only are children's diets contributing to this increase in childhood obesity, but children's physical and social environments, such as the school nutrition and physical activity environments, community resources, family interactions, and foods available at home, may also play pivotal roles in determining the risk for overweight and obesity. Significant decreases in physical activity and increases in screen time (computer, television, video games etc.) have been linked to both childhood and adult obesity (Dehghan, Akhtar-Danesh, & Merchant, 2005). In one study, 49% of school-aged children spent far more time watching television than the AAP recommendation of no more than two hours per day (Gingold, Simon, & Schoendorf, 2014). According to the 2008 Physical Activity Guidelines for Children and Adolescents, youth should participate in 60 minutes or more of physical activity every day (US Department of Health and Human Services) . Yet, only 42% of children, ages 6-11 years, meet this recommendation (Troiano et al., 2008). This may be attributed to both the home and school environments. While the physical activity environment may be difficult to measure, we know that with an increased focus on academic achievement, fewer elementary schools in the nation still require physical education classes every day and/or have daily recess (Branscum & Sharma, 2012).

Many children are engaged in after-school programs, thus having these after-school programs promote health and/or prevent overweight and obesity may help increase the number of children that have access to nutrition education and physical activity programs. Thus, the focus of the following literature review is after-school programs that focus on both nutrition and physical activity.

After-School Programs

The purpose of this review is to evaluate individual-level, after-school health promotion and obesity prevention programs that focus on nutrition education and physical activity. With the increase in two career households in the United States, the need for after-school care has become more prevalent (Branscum & Sharma, 2012). Social agencies can influence these after-school programs by providing after-school obesity prevention guidelines. The After-School Alliance (ASA) created its agenda for obesity prevention by developing guidelines for physical activity and nutrition education during after-school hours (After-School Alliance, 2004). The ASA states that after school is an excellent time for interventions to occur to increase children's wellbeing, as these times commonly result in a higher occurrence of screen time and other unhealthy habits. Therefore, an after-school program may provide the social influence and structured atmosphere to counteract these causes of childhood obesity. In their agenda, the ASA suggests that after-school programs should have physical activity opportunities every day that focus on continuing skill development. The ASA also recommends a comprehensive nutrition curriculum, focusing on the benefits of healthy foods as another important element in after-school programs. Teaching nutrition increases an after-school program's effectiveness at preventing obesity and promoting a healthy lifestyle (After-School Alliance, 2004).

After-school programs can be a path to preventing obesity and promoting health by increasing physical activity and nutrition education, while simultaneously giving children safe places during after-school hours, as well as positive, healthy environments (After-School Alliance, 2004). These programs have the resources of well-trained staff and the equipment to provide children with fun physical activity opportunities. They also provide a conducive learning setting where nutrition and physical activity curricula can be presented to a large number of children.

After-School Health Promotion and/or Obesity Prevention Programs with Physical Activity and Nutrition Education Components

One of the first after-school intervention programs researchers found to be successful in improving child health outcomes was the Coordinated Approach to Child Health (CATCH) Kids Club, which was a pilot after-school program to improve elementary students' nutrition and physical activity (Kelder et al., 2005). This program was funded by the National Heart, Lung, and Blood Institute and was designed for early prevention of cardiovascular disease. It consisted of 16 sites in Texas; eight sites served as intervention sites, and eight sites served as the control sites, with a sample size of 157 students with results at baseline and follow-up. The intervention group had 15 sessions of 30 minutes of nutrition education, 30 minutes of physical activity, and also included a snack during the after-school program once a week for 15 weeks. The nutrition, which focused on making better food decisions to prevent disease and to increase physical activity by various interactive activities, was divided by grades K-2 and 3-5. During the 30-minute exercise component, which were planned to be enjoyable and taught children developmental physical activity skills, children were involved in moderate-to-vigorous-intensity physical activity (MVPA) for at least 12 minutes (40% of the time). The snacks introduced children to new foods and provided ideas about how to prepare snacks. The study results showed significance increases in MVPA time and increases in overall physical activity time by 30 minutes among the intervention group. The After School Student Questionnaire showed increases in food choice self-efficacy, but not physical activity self-efficacy, and a significant increase in food knowledge. From the focus group conducted after the program, the children seemed to enjoy activities with fun equipment (bean bags, parachutes, and music). They did not appear to enjoy the nutrition education as much, because, as the program implementers said, the nutrition education was "too extensive and complex" (p.138) (Kelder et al., 2005). Focus group participants reported that the role-playing demonstrations helped to provide clarity for nutrition concepts, and children in the focus groups reported enjoying the snacks.

While the CATCH after-school study did not have many significant results, it did lay a sound basis for after-school programs to expand on and learn from. The after-school setting may provide a positive learning environment, but the CATCH study provided evidence that nutrition curriculum needs to be simple and hands on to engage children. The study also demonstrated the successfulness of physical activity programs, and the importance of proper implementation strategies for an after-school program.

The "Kids Living Fit" Program, another after-school program conducted in 2006, was successful with a significant decrease in BMI percentile compared to the control group (Speroni, Earley, & Atherton, 2007). The study involved 187 children (80 intervention, 107 control), and the intervention group met once a week for 12 weeks. The exercise component of the program focused on finding physical activity that the children enjoyed and could do on their own. The nutrition component was composed of four, 30-minute classes lead by registered dietitian nutritionists on the topics about best lunch choices, the United States food pyramid, portion sizes, and making best food choices at fast food restaurants. While the study showed a decrease in BMI percentile, there were no measurements reported on physical fitness or nutrition knowledge.

While the "Kids Living Fit" program may not have measured important after-school program outcomes, the pilot program "Be a Fit Kid", in 2008, was very successful, with significant improvement in all fitness measures, all body composition measures, nutrition knowledge and even some dietary habits (Slawta, Bentley, Smith, Kelly, & Syman-Degler, 2008). This 12-week program consisted of one research group of 75 elementary school-aged children who participated in this after-school program three times a week for two hours per session. The physical activity portion was more comprehensive than previous studies and introduced participants to basic components of fitness including flexibility, muscular strength, and cardiovascular endurance in a non-competitive environment for children. College students ran with the children at every lesson, while focusing on increasing their confidence. There was a 40% increase in participants who could meet the national standard for the mile run from baseline to post-intervention. The nutrition component focused on dietary guidelines, introduced new foods to try, and even included field trips to supermarkets. The program had a high rate of participation, which may have stemmed from an incentive program that gave away healthy foods, field trips, and shoe tokens as prizes. According to this article, the researchers reported that the key to successful nutrition education was, “to keep the concepts simple and expose the children to specific foods associated with concepts presented. Staff must be enthusiastic, supportive, and serve as role models” (p.309) (Slawta et al., 2008). The study resulted in 75% of the children increasing their intake of vegetables, fruits, whole grains, healthy fats, and water while decreasing consumption of unhealthy foods. Children also exhibited an increase in nutritional knowledge. Furthermore, the improvement in BMI from pre- to post-intervention was statically significant. The “Be a Fit Kid” program demonstrated the importance of having a well-planned unique program that engages and rewards children with a helpful staff in order to have an effective intervention.

Another intriguing after-school program was the Tommie Smith Youth Athletic Initiative (TSYAI), a 14-week program that aimed to decrease risk factors for childhood obesity in 5-10 year-old children (Topp et al., 2009). The TSYAI was implemented three times a week for 90 minutes per session, consisting of two days of track and field activities (included moderate-to-vigorous activity focusing on strength, flexibility, sprinting, and endurance running) and another day that included 45 minutes of nutrition education. Researchers tested fitness, body composition, and dietary habits. While BMI did not change, participants' cardiovascular fitness score improved, and more participants were able to complete the fitness test after the program than before. The study showed that participants consumed more green vegetables and less fruit juice based on pre- and post-study measures. One weakness of the program was inexperience among the staff in working with children, which may have resulted in less effective sessions.

The nutrition component was taught by nurses, nursing students, and registered nutritionist and focused on behavioral change. Every lesson was based on a different book coordinated with a fun in-class activity and a homework assignment such as filling out a blank food pyramid with the correct food groups. Another component was the education modules that consisted of behavior reinforcing activities, such as making a family tree of obesity and obesity-related diseases. The dietary data showed that participants improved their food choices as the intervention went on, demonstrating that the nutrition education was successful. As reported, there was a low completion rate of the homework and low participation from parents, so this was a less effective component of the study. While this was a conceptually comprehensive study, researchers made suggestions of being more culturally competent but reinforced the need for nutrition education and physical activity as a primary component for after-school programs.

In 2010, a similar program was implemented called HOP'N After-School Project but was conducted over a three-year period (Dzewaltowski et al., 2010). This was a larger study with about 245 third and fourth graders, which included 30 minutes of physical activity every day based on CATCH guidelines, in addition to a weekly nutrition and physical activity curriculum. While there were no significant changes in BMI, there were no increases in BMI in the experimental and control group. The study did show a significant increase in the amount of MVPA among overweight/obese children at the intervention sites, while at the control sites MVPA decreased. This study showed evidence that the obese/overweight children's amount of MVPA increased each of the three years they were in the program, while at the control sites it decreased each year; especially between baseline and year one. Yet, there was no difference seen in the amount of MVPA within the normal weight group between baseline and post-intervention. Participants did not increase the amount of servings of fruit and vegetables compared to the control site, and there were no measurements of cardiovascular physical fitness or nutrition knowledge.

What can be learned from Previous After-School Programs?

These studies show that after-school programs with nutrition education and physical activity can have a positive effect on health promotion with children. The studies show that nutrition education may need to be frequent in order to obtain significant improvements. Dietary habits and/or nutrition knowledge improved with most programs as long as nutrition was part of the program at least once a week. Another theme demonstrated by successful studies was making nutrition fun while keeping concepts simple. According to these study results, rewards could have a positive impact on participation and keep children interested. Another effective component may have been snacks, which introduced new foods to the children. This seemed to work in most programs by reinforcing healthy foods with lessons, and introducing children to foods they may not regularly consume.

Research has shown that as adolescents grow older they decrease MVPA time, and increase screen time, indicating the need for prevention programs to instill habits of being physically active as they grow up (Gordon-Larsen, Nelson, & Popkin, 2004). These studies showed that after-school programs can have an encouraging effect on children engaging in MVPA. This research shows that noncompetitive activities that were enjoyable seemed to be the most effective in increasing daily activity level and physical fitness. Focusing on non-competitive games may have helped children who typically get discouraged during exercise remain engaged.

While most research made improvements in healthy habits, significant effects on child weight status were less common. The studies that successfully had an impact on child weight status met more frequently and had longer physical activity periods (Slawta et al., 2008; Speroni et al., 2007). The "Be a Fit Kid" study was successful in decreasing BMI and increasing nutrition knowledge. A supportive staff who participated with the children while they focused on self-esteem may have contributed to the success of this program. Nutrition education with simple lessons involving a taste test may also have contributed to program success. Because of the mixed results among these health promotion and obesity prevention, after-school programs, there is a need for exploration of additional and perhaps novel approaches to increase effectiveness.

What's missing?

Research has shown that the more physically active children are, the more likely they are to be healthy and continue a healthy lifestyle into adulthood (Boreham & Riddoch, 2001). Furthermore, research suggest that physical activity can have a positive impact on youths' health, and increased self-efficacy can help promote positive health behaviors. Self-efficacy is a component of the Social Cognitive Theory, stating that individuals with higher self-efficacy are more likely to engage in certain actions or behaviors. The Social Cognitive Theory by Albert Bandura is a popular model used for behavior change, and suggests that knowledge of risk and benefits as well as the behavioral knowledge creates behavior change (Bandura, 2004).

According to this theory, not only is knowledge needed, but self-efficacy is also needed to overcome barriers that may hinder maintaining healthy lifestyle habits (Bandura, 2004). Research shows that self-efficacy is a strong predictor of behavior outcomes, and suggest interventions should focus on fostering the improvement of self-efficacy (Hall, Chai, & Albrecht, 2015). For after-school obesity prevention programs to be effective, children need to not only learn about eating healthy and being active, but create behavior change to make these practices habitual. One way to makes these habits more likely to occur is by increasing self-efficacy. Self-efficacy behavior change is built on four principal sources of information: performance accomplishments, vicarious experiences, verbal persuasion, and physiological states (Bandura, 1977). Since these components have shown to create behavior change via improved self-efficacy, it is important for obesity prevention programs to include these principles in their designs.

Because research suggests childhood is a time when sedentary behaviors increase and habits are created, it is essential to intervene during this time. The habit of being physically active and the associated health benefits are more likely to occur in adulthood if they can be established before adolescence (Telama et al., 2005). A correlational study of 6th and 8th-grade girls showed that the association between self-efficacy and physical activity was mediated by self-management strategies (Dishman et al., 2005). One self-management technique that has been suggested for use in interventions to increase self-efficacy is a log to track physical activity and self-monitor activity and/or dietary intake (McAuley, Szabo, Gothe, & Olson, 2011). Using a log to track fitness achievements and dietary habits to increase self-efficacy for elementary children is a novel idea, and is promising since self-management strategies have been shown to mediate physical activity and self-efficacy. Research using self-management strategies could close the gap in understanding if tracking physical and nutritional progress in children can help increase their physical activity self-efficacy.

Some interventions have been done to try to improve physical activity self-efficacy. A study using the Youth Fit For Life protocol compared self-efficacy measurements between a control group, 2003 group, and 2005 group (Annesi, 2006). All groups were enrolled in 12-week after-school programs, which included curriculum delivered three days per week for 45 minutes with non-competitive games, resistance training, and basic self-management/self-regulatory skills in a conversation group format. They had nutrition education for only 5 minutes each day. The 2005 group followed the same curriculum, yet had a more extensive self-management/self-regulatory component, which included workbooks, social support, and within group support to work on methods such as goal setting and measuring. The control group had unorganized physical activity and no self-efficacy building component. Results showed no significant difference between groups, yet within group statistics showed that the 2005 group significantly increased physical activity self-efficacy and the 2003 and control group did not. This study suggest that adding a self-management/self-regulatory component to an after-school program can increase physical activity self-efficacy but may need more self-management components to significantly increase self-efficacy between groups.

What can be done to help future after-school programs?

Health promotion and childhood obesity programs that incorporate nutrition education and physical activity are important to help teach children how to eat healthy and develop an appreciation for the importance of physical activity. Because of the need for after-school programs, these components can be incorporated into existing and new programs. The review of the literature provided some ideas that may need to be considered when developing or adapting after-school health promotion and/or obesity prevention programs. Several of the programs described in the literature focused on physical activity, but it is unclear whether or not they ensured that the children were moving enough to develop fitness levels and/or to increase their heart rates. The literature also revealed that nutritional education components need to be interactive and let participants "play while they learn." Also, the literature suggests that snacks should be included with the lessons to reinforce nutrition education concepts and to provide hands-on visualization and taste.

Areas that need to be strengthened in intervention include homework, parent participation, nutrition education lessons, as well as staff training. Parent participation with homework may be improved by providing incentives to children and parents to motivate participation. Nutrition education needs to be more interactive and hands-on in order to try to increase effectiveness. Other factors that may need to be avoided are having nutrition education less than once a week, overly complex nutrition lessons, and the absence of visuals. Furthermore, for an after-school program to remain preventive throughout a child's life, it is important for nutrition knowledge to increase. Lastly, physical activity considered mundane or competitive did not seem to work well with children in these studies.

Another recommendation for future programs is to recognize the importance of directors' and program staff members' attitude and how role modeling may impact the effectiveness of the program. Additionally, adequate staff training is necessary to ensure all implementers understand the goals and are prepared. A knowledgeable, well-trained staff with experience with children is ideal for effective interventions. Staff members must maintain a level of excitement to energize children about nutrition- and physical activity-related concepts. Furthermore, staff members potentially have the power of being role models to children in after-school programs, helping to reinforce these healthy behaviors.

Conclusion

In order for children to live healthy lives and meet their potential, child health and obesity prevention must be part of the United States public health agenda. The after-school environment is a promising resource for children, by providing them a safe place to have fun while increasing physical activity and participating in hands-on nutrition education. Healthy eating habits and the knowledge to establish these habits are essential life skills necessary for the overall improvement of the quality of life as youth transition to adults. If obesity prevalence remains at high rates or increases, it has been predicted that average life expectancy will start to decrease for the first time in human history, meaning children may start living less healthier lives and have shorter lifespans than their parents (Olshansky et al., 2005). Without intervention, the cycle of obesity caused by poor eating habits and inactivity will likely continue. Action needs to be taken during after-school hours to implement nutrition education and physical activity programs to improve health and decrease rates of childhood obesity.

The purpose of the iRun research project, which is described in the following chapter, was to evaluate differences among two modes of intervention to increase nutrition knowledge and preference, physical fitness, and physical activity self-efficacy. The research questions was, is there significant differences in nutrition knowledge and preference, physical fitness, and physical activity self-efficacy among conventional and experimental intervention groups' pre- and post-intervention?

Chapter 2

Manuscript

Introduction:

Because of the high childhood obesity prevalence rates, experts have predicted that average life expectancy in the United States will decrease for the first time in human history, meaning children will live less healthy and shorter lives than their parents (Fryar, 2014; Olshansky et al., 2005).Without intervention, the cycle of obesity caused by poor eating habits and inactivity will likely continue because research has shown that children who are overweight or obese are more likely to be overweight or obese in adulthood (Freedman, 2001). Evidence shows healthy eating habits and the knowledge to establish these habits are important life skills. Since eating patterns early in life are associated with obesity risks later in life, healthy eating habits may be necessary for the overall improvement of quality of life as America's youth transition to adulthood (Baidal, 2012).

According to the Centers for Disease Control and Prevention, most children do not meet the dietary recommendation for consuming fruits and vegetables or whole grains (Centers for Disease Control and Prevention, 2014). Children also ingest up to 40% of their daily calories from added sugars and solid fats, and drink more soft drinks than milk (Centers for Disease Contro and Prevention, 2013). About 50% of these low nutrient calories come from sugar-sweetened beverages, desserts, pizza, and whole milk (Reedy & Krebs-Smith, 2010). The absence of nutrition knowledge along with these lifestyle behaviors may be contributing to the increase in the childhood overweight and obesity (Centers for Disease Control and Prevention, 2012). Research has shown there is a greater improvement in dietary habits when nutrition education is provided to children (Powers et al., 2005). Nutrition education can help combat the childhood obesity epidemic by promoting healthy eating to create positive eating behaviors (Powers et al., 2005). Nutrition education that is interactive and provides practical application has been shown to be most effective at improving nutritional knowledge (Kelder et al., 2005). If children develop the knowledge to make healthier choices at younger ages, they are less likely to develop unhealthy habits and become overweight later in life (Birch, 2007).

In addition to the role of eating behavior in health, the more physically active a child is, the more likely he/she is to be healthy and continue a healthy lifestyle into adulthood (Boreham & Riddoch, 2001). Because as children age they may become more sedentary, it is key to intervene early in childhood to help establish healthy habits (Caspersen, Pereira, & Curran, 2000). Research suggests that development of physical activity behaviors prior to adolescence increases the likelihood that these behaviors, and their associated benefits, will continue into adulthood (Telama et al., 2005). According to the 2008 Physical Activity Guidelines for Children and Adolescents, youth should participate in 60 minutes or more of physical activity every day, yet only 42% of children, ages 6-11 years, meet this recommendation (U. S. Department of Health and Human Services, 2008; Troiano et al., 2008). Studies have shown that children increase their physical activity if their belief in their ability to be active is strengthened (Ryan & Dzewaltowski, 2002).

Self-efficacy is a component of the Social Cognitive Theory, which postulates that individuals with higher self-efficacy are more likely to engage in certain actions or behaviors (Bandura, 1991). It has been hypothesized that by increasing self-efficacy, children will be more likely to stay physically active throughout life (Bandura, 2004). Research has shown the association between self-efficacy and physical activity is mediated by self-management strategies (Dishman et al., 2005). One self-management technique used to increase self-efficacy in interventions is a log to track physical activity and dietary intake (McAuley et al., 2011). Though this has been shown to be successful in adults, the use of a log to track fitness achievements and dietary habits to increase self-efficacy among elementary children is novel and may be a promising component for nutrition and physical activity programs.

After-school programs can provide a path to preventing obesity and promoting health by increasing physical activity and nutrition education, while simultaneously giving children a safe place during after-school hours, as well as a positive, healthy environment (After-School Alliance, 2004). These programs have the potential resources of a well-trained staff and the equipment to provide children with fun physical activity games. They give children the option to be physically active during a time when most children are likely to be sedentary (After-School Alliance, 2004). They also provide a conducive setting where nutrition curriculum can be presented to a large number of children (After-School Alliance, 2004). They can aid minority children and those in poverty, who are most at risk for being overweight, as well as helping children form healthy habits by connecting with them during an important stage (U. S. Department of Health and Human Services). After-school programs can provide the optimal setting for promoting healthy lifestyles in children (After-School Alliance, 2004).

The iRun program, an after-school program, was developed to increase physical fitness. The conventional iRun program does not contain any nutrition education or focus on increasing self-efficacy for being physically active. The purpose of this study was to determine if enhancing the conventional iRun program with the addition of nutrition education lessons and a fuel and fitness log designed to increase self-efficacy for physical activity would have more positive outcomes (in nutrition knowledge and physical activity self-efficacy) than just the conventional approach.

Methods

Participants

All participants were 8 to 12 years old, from three after-school programs in East Tennessee. The experimental intervention group's sample size was 38 and the conventional intervention group's sample size was 16.

Recruitment and eligibility

All third through fifth graders attending the selected schools during the time of this study were recruited for participation. Participants were recruited through the physical education teachers and flyers that were sent home. A parental consent form with information about the study was sent home with students. Fifty-four students obtained parental consent and were asked for their oral assent prior to completing any outcome measures. All 54 students assented and completed the program, but only 52 (38 and 14 in the experimental and conventional groups, respectively) completed all aspects of the outcome measurements. Each participant was assigned a personal identification number to allow follow-up comparison of data, while protecting the identity of participants.

Intervention

The conventional iRun was a pilot program designed to teach third through fifth grade students how to run and train for races with the support of a local children's hospital and a marathon organization. The iRun program was originally planned to be a 12-week program; however, due to inclement winter weather the program had to be reduced to 10 weeks. The primary objective of this project was to evaluate if there were significant differences in physical fitness levels and nutrition knowledge and preference between conventional intervention and experimental intervention groups from baseline to completion of the program. The secondary objective of this project was to determine if there were significant differences in physical activity self-efficacy between conventional intervention and experimental intervention groups from baseline to completion of the program. Human subjects' approval was obtained from The University of Tennessee Institutional Review Board before data collection began.

Study Design

This study was a convenience sample, pre-and post-test, quasi-experimental design with between-subject factors of a conventional program and an enhanced program (enhanced with nutrition education and fitness log) (Table 1). Changes in physical fitness, nutrition knowledge and preference, and self-efficacy were dependent variables. The two modes of intervention, experimental and conventional, were the independent variables.

Table 1 Overall Study Design of the iRun Program Intervention, 2015

Group	iRun physical activity + snack	Nutrition Education	Fitness Log
Experimental intervention n=38	X	X	X
Conventional intervention n=14	X		

iRun Physical Activity

The iRun physical activity took place for 45 minutes once a week for eight weeks. The program was created by an employee at a local children's hospital with a degree in kinesiology and experience working with children in nutrition and physical activity programs. The physical activity sessions were comprised of instruction about proper running form, warm-up, and running exercise, followed by a game and cool down. It provided moderate-to-vigorous physical activity, throughout the sessions. The physical activity component met the World Health Organization definition of moderate and vigorous physical activity with a mixture of activities designed to require a moderate amount effort and a large amount of effort (World Health Organization, 2015). The exercises were non-competitive and a trained instructor helped to ensure the safety of participants. Instructors had experience with previous after-school programs and were encouraged to be positive role models by reinforcing the healthy behaviors learned. Shoe tokens were given as rewards to students who displayed positive behaviors during the sessions. The cost of the one-mile fun-run, which was held in association with the city marathon, was waived for participants so that all had the opportunity to run at the highly publicized event at the conclusion of the program. The activities posed no more risk than a typical physical education class or recess period. The experimental and conventional group received all the components of the physical activity curriculum.

Nutrition Education

This study used nutrition education materials derived from the Coordinated Approach to Child Health (CATCH) material, which has been shown to significantly increase nutritional knowledge among similar samples of children (Kelder et al., 2005). The curriculum was designed for after-school students in third through fifth grade and was modified to focus on educating children about healthy foods, especially those that fuel aerobic activity and running. Nutrition education sessions were approximately 15 minutes long once a week and included a snack. The iRun nutrition curriculum was comprised of 8 lessons: 1) Importance of Hydration, 2) Power Carbohydrates, 3) Fueling Your Run with Fruit, 4) Protein Helps Build muscles 5) The Color of Vegetables Benefits 6) Calcium Builds Strong Bones 7) Importance of a Healthy Breakfast 8) Fuel Your Body Properly. Only the participants in the experimental intervention group received nutrition education. Participants in the conventional intervention received the same snack, but did not receive nutrition education. Instead they played a sedentary game to decrease the effect of exposure time between groups.

Fuel and Fitness Log

The fuel and fitness log was developed based on previous self-efficacy building tools and concepts (Bandura, 2004; Bandura, 2006). The fuel and fitness log combined reflection on physical activity and eating behaviors. The physical activity portion focused on participants' effort and confidence in ability in order to see how these factors improved over the project. The nutrition portion focused on how participants felt their diet affected their performance, as well as assisting with tracking the food groups consumed in the last twenty-four hours preceding each lesson.

Participants in the experimental group were given a fuel and fitness log to complete after each lesson. The trained nutrition educator instructed the children about how to complete the log during the first nutrition education lesson and assisted with completion at subsequent lessons. The logs were collected after each lesson and given back to students at the end of the program. All logs that were handed out were completed and returned to the research staff.

Outcome Measures

All outcome measures were obtained by trained research assistants.

Body Mass Index (BMI) z-Scores

Height and weight, date of birth, and sex were collected by the research team to calculate BMI z-scores and the percent of children classified as healthy, overweight, and obese. Height and weight was collected using CDC protocol on standardized scales and stadiometers (pre-and post-test) (Centers for Disease Control and Prevention, 2015). BMI z-scores and weight status were calculated from the data using the CDC's BMI z-score conversion formula (Centers for Disease Control and Prevention, 2009).

Fitness Gram Progressive Aerobic Cardiovascular Endurance Run (PACER)

Changes in third through fifth graders' physical fitness was assessed by the Progressive Aerobic Cardiovascular Endurance Run (PACER), which has been validated and shown to be an accurate evaluation tool to use to measure aerobic fitness and running improvement in children and was appropriate for all grade levels included in this study; it posed no more than minimal risk (Mahar, Guerieri, Hanna, & Kemble, 2011; Rise, 2015).The test was completed by participants running between two lines in time to recorded beeps. As the test progressed the time decreased between recorded beeps, so the pace increased. The subjects continued until they could not keep pace with the beeps.

Irun Survey

All participants enrolled in the iRun program with written parental consent and who provide verbal assent completed the survey on two separate occasions (pre-and post-) at each of the after-school programs. The study used a survey that contained: 1) nutrition knowledge and preference questions; 2) self-efficacy for physical activity questions; and 3) social desirability questions.

Nutrition Knowledge

Nutrition knowledge and preference was assessed using the nutrition knowledge and preference sections of the validated CATCH after-school student questionnaire, which has been used in other similar studies (Kelder et al., 2005). The dietary preference section contained 8 questions, and was scored by adding up the points for each answer (2 points for the healthier choice and 1 point for the less healthy choice); thus the maximum score was a 16. The nutrition knowledge section was scored the same way except with 10 questions; therefore the maximum score was 20.

Physical Activity Self-Efficacy

Self-efficacy for physical activity was assessed with the validated physical activity self-efficacy section from the CATCH after-school student questionnaire, which too has been used for similar samples in previous studies (Kelder et al., 2005). This survey contained five questions and was scored by adding up the points of each answer (1 point for not sure, 2 points for a little sure, 3 points for very sure); the maximum score was 15 points.

Social Desirability

Social desirability is a potential bias when collecting data in this age group; thus the Short-Form of the Children's Social Desirability Scale for Nutrition and Health-Related Research was used to allow researchers to account for the impact that social desirability may have on the survey data collected (Klesges et al., 2004). Social desirability was measured with a short form version that was validated specifically for children in nutrition and health related research (Miller et al., 2014) . This survey was scored by calculating the total number of "yes" answers out of the 14 questions (No=0, Yes=1); the maximum score was 14 points.

Results

Comparison of the experimental (n=38) and conventional group (n= 14) using a Chi Squared test showed no significant difference in demographic characteristics such as grade in school, BMI categories, race, or ethnicity at baseline (Table 2; p>0.05). All dependent variables were tested for normality using the Shapiro-Wilk test and did not meet the normality assumption; and therefore non-parametric tests were used to analyze the dependent variables with an alpha set at 0.05. All dependent variables and age were tested for baseline differences using Wilcoxon Rank Test and showed no significant differences (p>0.05).). Social desirability was not used as a control variable, because there was no significant difference between groups' social desirability scores (P>0.05).

Characteristics

Children (N=52) were mostly Caucasian; there were also 10.2% African American, and 14.3% who were more than one race. Most were in the third grade, with an average age of 10 years. The majority of participants in both groups were at a healthy weight. There were no significant differences in BMI percentile at baseline between groups (p >0.05). BMI percentiles were assessed to ensure there were no unhealthy weight losses among participants. There was no change in BMI percentile from pre-to post-intervention overall or by group (p >0.05)

Table 2 Baseline Characteristics of the iRun Experimental and Conventional Groups (N=52)

Characteristic	Experimental Group Percentage (N=38)	Conventional Group Percentage (N=14)
Race		
Caucasian	71.4%	85.7%
African American	11.4%	7.1%
More than one race	17.1%	7.1%
Ethnicity		
Hispanic	9.1%	0%
Not Hispanic	90.9%	100%
Healthy BMI percentile	60.0%	57.1%
Age		
8	10.5%	7.1%
9	36.8%	71.4%
10	23.7%	14.3%
11	23.7%	7.1%
12	5.3%	0.0%
Grade		
3	38.9%	50.0%
4	27.8%	35.7%
5	33.3%	14.3%

Within-group comparisons

A Wilcoxon signed-rank test was used to examine within-group changes, of nutrition knowledge and preference, physical fitness, and physical activity self-efficacy, since the variables were not normally distributed. Nutrition knowledge, nutrition preference, physical fitness and physical activity self-efficacy increased significantly from baseline in the experimental group (p's < 0.05). Only physical fitness significantly increased from baseline in the conventional group ($p < 0.05$).

Table 3 iRun Within Group Pre to Post Intervention Differences (N=52)

	Experimental (n=38)			Conventional (n=14)		
Measure	Pre-mean (SD)	Post-mean (SD)	Pre/post mean difference (SD)	Pre-mean (SD)	Post-mean (SD)	Pre/post difference (SD)
Nutrition Knowledge	17.3 (2.2)	18.7 (1.8)	1.4 (1.9)*	17.3 (2.4)	17.5 (2.4)	0.2 (1.7)
Nutrition Preference	12.2 (2.6)	14.2 (1.9)	2.1 (2.1)*	12.1 (1.5)	11.7 (1.5)	-0.4 (.8)
Physical Fitness (PACER)	22.8 (12.4)	29.7 (12.3)	6.9 (9.4)*	20.7 (12.7)	24.6 (15.2)	3.7 (5.0)*
Physical Activity Self Efficacy	9.7 (1.8)	11.1 (2.4)	1.4 (3.2)*	10.1 (2.6)	10.4 (2.2)	0.4 (3.5)

*p<.05

Between-group comparisons

A Mann-Whitney test was used to assess between-group differences from baseline to post-intervention for the experimental versus conventional groups. Between-group comparisons showed that the experimental group's nutrition knowledge and nutrition preference significantly increased from pre- to post-intervention compared to the conventional group (p's < 0.05). Physical fitness and self-efficacy for physical activity did not increase or decrease significantly between groups (p>0.05).

Discussion

The purpose of this study was to evaluate the outcomes of the enhanced iRun program, which incorporated both nutrition education and a focus on improving physical activity self-efficacy on participants' physical fitness, nutrition knowledge and preference, and self-efficacy for physical activity. The enhanced iRun program was designed to help instill healthier habits in children to help prevent childhood obesity. Because childhood is when physical activity habits are more likely to be formed, this age-group represented optimal timing for the prevention of obesity (Gordon-Larsen et al., 2004). Previous studies with adults demonstrated that keeping track of fitness performance and dietary intake increases self-efficacy and increases the likelihood of maintaining physical activity levels (E. McAuley, Courneya, Rudolph, & Lox, 1994). However, it is unknown whether these behavior monitoring techniques would also increase children's physical activity and/or physical activity self-efficacy.

Nutrition knowledge and nutrition preference increased significantly in the experimental compared to the conventional group, which may be indicative of the strength of the nutrition curriculum, which used visuals and was interactive (Kelder, 2005). Results related to nutrition knowledge and preference have been inconsistent in previous studies for programs that met weekly, similar to iRun, and even for those programs that met more often and/or for longer durations (Slawta et al., 2008; Speroni et al., 2007; Topp et al., 2009). The use of the fuel and fitness log, which had children record what food groups they consumed at their previous meals, may have helped reinforce the nutrition education concepts taught during the lessons.

Furthermore, physical fitness increased significantly in the experimental and conventional groups. This was expected because both groups received the same amount of physical activity. This positive finding for the iRun program is important because increased physical fitness in general is an important component of childhood obesity prevention programs. This result is likely due to the use of running as the main component of physical activity, which is moderate to vigorous physical activity and has been shown to help increase cardiovascular fitness (Strong et al., 2005). Improving cardiovascular fitness is important in obesity prevention programs since research shows cardiorespiratory fitness levels are associated with total and abdominal adiposity, as well as cardiovascular disease risk factors (Ortega, Ruiz, Castillo, &

Sjostrom, 2007). The physical activity in this program was designed to be enjoyable and non-competitive, which similar research has shown to be an effective component of physical activity programs (Slawta et al., 2008). A similar pilot program, “Be a Fit Kid,” showed significant improvement in one mile run test times using non-competitive running led by college students as part of the physical activity component (Slawta et al., 2008). However, this program met three times a week for two hours, whereas iRun met only once a week for one hour. Furthermore, they had no conventional group and did not measure physical activity self-efficacy (Slawta et al., 2008). There is a lack of research on incorporating running as physical activity into childhood obesity prevention programs while measuring physical fitness and physical activity self-efficacy outcomes. The iRun study rewarded participants who worked hard and encouraged other participants during the physical activity with shoe lace tokens. These tokens were offered to both groups. Furthermore, the iRun study incorporated a one-mile fun run at the end of the program for both groups, associated with a marathon, which may have helped encourage the children to increase physical fitness.

Finally, the experimental group increased physical activity self-efficacy significantly, from baseline, and the conventional group did not; however, there was not between group differences. Previous after-school programs with nutrition education and physical activity components saw no significant improvements in physical activity self-efficacy in the experimental group without a self-efficacy building component (Kelder et al., 2005). A similar after-school program, “Youth Fit For Life”, added a self-management/self-regulatory component to their after-school program that included using a workbook to work on methods such as goal setting (Annesi, 2006). This 12-week study found the experimental group significantly improved from baseline to post-intervention, and the conventional group did not (Annesi, 2006). The iRun study’s self-management technique of using a fuel and fitness log to track participants’ progress and confidence in being active is a unique technique that had not been used in children yet. The results for this study did not show between group differences for physical activity self-efficacy, but because an increase was seen within the experimental group, this novel technique of connecting physical activity improvements with the self-management activities is promising and may be an important addition to other research projects related to physical fitness.

Strength and Limitations

The iRun study had several strengths, including the use of nutrition education, physical activity, and self-management strategies, targeting health changes in children, which were implemented throughout the program. Furthermore, this study had a quasi-experimental design, which allowed for the analysis of two different groups to test the components of the intervention. Validated surveys and physical fitness measurements were used which increased the validity of the results. Furthermore all data collected for analysis, including height and weight, were obtained by trained research assistants.

One limitation of this study was the lack of randomization. Randomization of students was not possible because they had to participate at their school sites. Another limitation was that the fuel and fitness log was not validated prior to implementation, but was seen as a novel addition to pilot in this program. Other possible limitations are the short duration of the program and the small sample size. The small sample size, especially in the control group, is a limitation. However, this was unavoidable because the sites were determined by the sponsor of the program (the children’s hospital). Larger, more robust samples may produce different results, but the results of this pilot program are promising because the program increased nutrition knowledge and preference, physical fitness, and physical activity self-efficacy among the intervention group.

Between-group differences were not seen with physical activity self-efficacy and physical fitness and the researchers are unable to determine if this was due to the small sample size or to program components; thus further research is needed, including validation of the fuel and fitness log.

In conclusion, the iRun program showed that combining physical activity, nutrition education, and a fuel and fitness log increased nutrition knowledge and preference, physical fitness, and physical activity self-efficacy in the experimental group, while only physical fitness increased in the conventional group.. Although between-group differences could not be determined for self-efficacy and physical fitness, these are important findings for after-school obesity prevention programs, as these additions may increase program effectiveness of fostering healthy habits in children. If more after-school programs are able to positively impact self-efficacy, it may help increase the likelihood that these children will keep these healthy behaviors into adulthood. Furthermore, if these children can maintain these healthy lifestyle skills, risk of future obesity may be decreased. Other similar comparison studies could not be found, thus showing the need for more research in this area. With childhood obesity prevalence rates remaining high, it is imperative interventions are implemented during after-school programs to stop the cycle of obesity caused by poor eating habits and inactivity (Chery D. Fryar, 2014).

Chapter 3

Expanded Methods

Participants

The groups consisted of 52 students from three after-school programs. The participants were 8-12 years old in third through fifth grade. The participants were grouped into two arms, the experimental intervention and the conventional intervention.

Recruitment and eligibility

All third through fifth graders attending the selected schools during the time of this study were recruited for participation. Participation was contingent upon parental written consent and student oral assent. A parental consent form with information about the study was sent home with students. Students who obtained parental consent were asked for their oral assent prior to completing the PACER fitness assessment and the iRun survey, which consisted of nutrition knowledge and preference, self-efficacy for physical activity, and social desirability components.

Each participant was assigned a personal identification number to allow follow-up comparison of data, while protecting the identity of participants. Only the principal investigator (PI) and faculty advisor (Co-PI) had a list of students' names corresponding to the personal identification numbers. The list was stored securely in the Co-PI's locked filing cabinet in Jessie Harris Building.

Methodology

Study Design

This study was a convenience sample, pre-and post-test, quasi-experimental design with between-subject factors of nutrition education (receive education and do not receive education) and a fitness log (receive fitness log and do not receive fitness log) (Table 4). Changes in third through fifth graders' physical fitness was assessed by the PACER; nutrition knowledge and preference, and self-efficacy for physical activity, and social desirability was assessed using validated surveys that were modified for this project. Changes in physical fitness, nutrition knowledge and preference, and self-efficacy are the dependent variables. Social desirability scores would have been used to control for these characteristic, but there was no significant differences between groups.

Table 4 Overall Study Design of the iRun Intervention (n=52)

Group	Physical Activity + Snack	Nutrition Education	Fitness Log
Experimental intervention: School 1 & 2 (n=38)	X	X	X
Convention intervention: School 3 (n=14)	X		

iRun Physical Activity

The iRun physical activity took place for 45 minutes once a week for eight session. The program was created by an employee at East Tennessee Children's Hospital who has a degree in kinesiology and experience working with children in nutrition and physical activity programs. The physical activity sessions were comprised of instruction on proper running form, warm-up, running exercise, a game, and a cool down. The exercises were non-competitive and had a trained instructor to help ensure the safety of participants. Instructors had experience with previous child after-school programs and were encouraged to be positive role models. The activities posed no more risk than a typical physical education class or recess period.

Nutrition Education

This study used nutrition education materials derived from the Coordinated Approach to Child Health (CATCH) material, which were reviewed by three registered dietitians. The curriculum was designed for after-school students in third through fifth grade and focused on educating children on healthy food especially those that fuel aerobic activity and running. Nutrition education was about 15 minutes long including a snack. The iRun nutrition curriculum was comprised of 10 lessons: 1) Importance of Hydration, 2) Power Carbohydrates, 3) Fueling Your Run with Fruit, 4) Protein Helps Build muscles 5) The Color of Vegetables Benefits 6) Calcium Builds Strong Bones 7) Importance of a Healthy Breakfast 8) Slow Fuel: Sugar 9) Super Food to Make You a Super Star! 10) Fuel Your Body Properly. Yet, due to winter weather school closings only eight of the lessons were able to be taught. The Slow Fuel: Sugar lesson was combined with the Importance of a Healthy Breakfast lesson and Super Food to Make You a Super Star was not taught. Each lesson provided the researcher with a list of preparation materials, food(s) needed for snack, and lesson plan. The control school still got a snack, but did not receive nutrition education. They played a non-physical activity game to decrease the effect of exposure time.

Fuel and Fitness Log

Participants in the experimental group were given a fuel and fitness log that was developed specifically for this project. The children were asked to complete the log after each lesson based on their dietary intake in the 24 hours preceding the lesson and how they felt at the end of each lesson. The logs were collected after each lessons and given back to students at the end of the program.

Outcome Measures

Body Mass Index (BMI) z-Scores

Height and weight, date of birth, and sex were collected by the research team to calculate BMI z-scores. Height and weight were collected using CDC protocol on standardized scales and stadiometers (pre-and post-test). Students were weighed and measured in an area that provided adequate privacy to prevent anyone other than the research team member from viewing the data, but did not seclude the team member and students from others. The PI supervised all anthropometric measurements. Neither the anthropometric data nor the CDC classifications were shared with students. If the parents of participants requested the anthropometric data and/or the CDC classifications, the information would have been mailed to the parent with a brief explanation about healthy weight gain during childhood. No parents requested the information during the study. BMI z-scores were calculated from the data using the CDC's BMI z-score conversion formula. In addition, BMI weight categories (obese, overweight, and normal) were also calculated.

Fitness Gram Progressive Aerobic Cardiovascular Endurance Run (PACER)

All participants with written parental consent and who provided oral assent in grades 3-5 completed the PACER run on two separate occasions (pre-and post-test) at each of the three sites. The PACER test, which is a validated fitness test that has been used in previous studies, established participant's baseline cardiovascular fitness level and running improvement; it is appropriate for all grade levels and included no more than minimal risk (Rise, 2015). The test was completed by participants running between the two lines in time to recorded beeps. The time decreased between recorded beeps each minute, so pace increased. The subjects continued until they could not keep pace with the beeps.

Survey

All participants enrolled in the iRun program with written parental consent and who provide verbal assent completed the survey on two separate occasions (pre-and post-) at each of the three after-school schools. The study used a survey that contained: 1) nutrition knowledge and preference questions that were modified from a validated survey to test knowledge in the concepts related to the nutrition education curricula and preference of healthful foods; 2) validated physical activity self-efficacy questions; and 3) validated social desirability questions.

Data were entered by personal identification number only, by trained research team members. This protected the identity and confidentiality of participants. Data were stored on password protected files on the server. Only research team members had access to these files. Data were analyzed by group means and frequencies. Mean scores for each survey domain and PACER scores were compared between the comparison groups and by BMI z-scores to test effectiveness of the intervention.

Statistical analysis

All statistical analysis was conducted using SPSS (version 21.0). Data was entered into excel using double entry, and checked to ensure both data entries were the same and correct. A Chi Squared test was used for the comparison of demographic characteristics of grade in school, BMI categories, race and ethnicity at baseline between experimental and conventional group. All dependent variables were tested for normality using the Shapiro-Wilk test and did not meet the normality assumption; and therefore non-parametric tests were used to analyze the dependent variables with an alpha set at 0.05. All dependent variables and age were tested for baseline differences using Wilcoxon Signed-Rank test. A Wilcoxon signed-rank test was used to analyze with-in group differences of BMI percentiles, social desirability, nutrition knowledge and preference, physical fitness, and physical activity self-efficacy from pre-to-post in the experimental group and the conventional intervention group. A Mann-Whitney test was used to access the dependent variables differences from baseline to post-intervention for the experimental versus conventional group.

Table 5 Summary of Statistical Analysis of iRun Intervention

<table>
<tr><th colspan="4">iRun Survey</th></tr>
<tr><td>Independent Variables</td><td colspan="3">Intervention: iRun program (Groups 1,2), Nutrition Education (Group 2), Fitness Log (Group 2)</td></tr>
<tr><td>Dependent Variables</td><td colspan="3">Changes in physical fitness, nutrition knowledge, and self-efficacy; changes in BMI z-scores</td></tr>
<tr><th colspan="4">Variable Construction</th></tr>
<tr><td>Nutrition Knowledge:
CATCH After School Survey
(2 points) for healthier choice and (1 point) for less healthy choice.
(Maximum 20 points)

Nutrition Preference:
(2 points) for healthier choice and (1 point) for less healthy choice
(Maximum 16 points)</td><td>Physical Activity Self Efficacy:
5 Items
1 points for Not Sure
2 points for A little sure
3 points for Very sure
(Maximum 15 points)</td><td>Social Desirability Score:
Calculated by summing the total number of “yes” answered
No-0
Yes-1
(Maximum 14 points)</td><td>Cardiovascular Fitness Test
1 point for every lap</td></tr>
</table>

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Vita

Julia Bell was born and raised in Nashville, Tennessee. She grew up active in sports during which she realized the importance of proper nutrition and its impact on performance and health. Realizing she had a passion for sharing this knowledge with others, she attended the University of Tennessee and received her Bachelors of Science in Nutrition. In the fall of 2014, she began her pursuit of a Masters of Public Health Nutrition. During this time she loved working as a Sports Nutrition Intern, being able to combine her love of sports and nutrition by working with Tennessee Athletics. Her research of childhood obesity prevention programs enabled her to follow her passion of combating and preventing childhood obesity. She hopes to pursue a career which allows her to facilitate her knowledge while motivating others to achieve their wellness goals.